CLAIMS

The embodiments of the invention in which an exclusive property or right is claimed are defined as follows. Having thus described the invention what is claimed is:

1. A multiple modes sensing system, comprising:

an acoustic wave sensor comprising a plurality of sensing components for monitoring a chemical species, wherein said plurality of sensing components is disposed within a cavity formed from a plurality of walls of said acoustic wave sensor, wherein each sensing component of said plurality of sensing components is coated with a differing sensing film; and

a plurality of oscillators associated with said plurality of sensing components, wherein each sensing components of said plurality of sensing components is located in a feedback loop with an oscillator of said plurality of oscillators to thereby provide a multiple mode acoustic wave sensor that provides multiple mode frequency outputs thereof, wherein a calculated difference among said multiple mode frequency outputs is utilized to promote an increase in sensing accuracy by eliminating responses due to environmental changes other than said monitored chemical species.

2. The system of claim 1 wherein each sensing component of said plurality of sensing components comprises a quartz crystal.

3. The system of claim 1 wherein said multiple modes frequency outputs comprise at least one of the following types of data: flexural plate mode (FMP) data, acoustic plate mode data, and shear-horizontal acoustic plate mode (SH-APM) data.

4. The system of claim 3 wherein said multiple mode frequency outputs

further comprises at least one of the following types of data: amplitude plate mode (APM) data, thickness shear mode (TSM) data, surface acoustic wave mode (SAW), and bulk acoustic wave mode (BAW) data.

5. The system of claim 4 wherein said multiple mode frequency outputs further comprises at least one of the following types of data: torsional mode data, love wave data, leaky surface acoustic wave mode (LSAW) data, and pseudo surface acoustic wave mode (PSAW) data, and at least one multiple mode acoustical vibration amplitude.

6. The system of claim 5 wherein said multiple mode frequency outputs further comprises at least one of the following types of data: transverse mode data, surface-skimming mode data, surface transverse mode data, harmonic mode data, and overtone mode data.

7. The system of claim 5 wherein said at least one multiple mode acoustical vibration amplitude is controlled by said plurality of oscillators.

8. The system of claim 7 wherein said at least one multiple mode acoustical vibration amplitude is controlled by said plurality of oscillators in order to produce vibrations for shaking away analytes from bonding surfaces thereof.

9. The system of claim 1 said acoustic wave sensor comprises a SAW sensor.

10. The system of claim 9 wherein said SAW sensor comprises a humidity sensor, which provides multiple modes that shake away any water droplets condensing upon said SAW sensor, thereby permitting said SAW sensor to recover quickly from water saturation.

11. The system of claim 1 wherein said multiple mode acoustic wave

sensor produces vibrations which break down bonding connections between analytes and said plurality of sensing components.

12. The system of claim 1 wherein said sensing components of said plurality of sensing components comprise electrode materials chosen from among a group comprising at least one of the following metals: Al, Pt, Au, Rh, Ir, Cu, Ti, W, Cr, and Ni.

13. The system of claim 1 wherein said sensing components of said plurality of sensing components comprise electrode materials chosen from among a group comprising at least one of the following alloys: TiN, CoSi2, and WC.

14. The system of claim 1 wherein said sensing components of said plurality of sensing components comprise electrode materials chosen from among a group comprising at least one of the following metal-nonmetal compounds: NiCr and CuAl.

15. A dual modes sensing system, comprising:

an acoustic wave sensor comprising two sensing components for monitoring a chemical species, wherein each sensing component are disposed within a respective channel within a cavity formed from a plurality of walls of said acoustic wave sensor, such that each of said sensing components is coated with a differing sensing film; and

two identical oscillators associated with said sensing components, wherein each of said sensing components is located in a feedback loop with each of said two identical oscillators to thereby provide a dual mode acoustic wave sensor that provides dual mode frequency outputs thereof, wherein a calculated difference among said dual mode frequency outputs is utilized to promote an increase in sensing accuracy by eliminating responses due to

environmental changes other than said monitored chemical species.

16. The system of claim 15 wherein each sensing component comprises a quartz crystal.

17. The system of claim 15 wherein said dual mode acoustic wave sensor produces vibrations which break down bonding connections between analytes and said plurality of sensing components.

18. The system of claim 15 wherein said sensing components comprise piezoelectric materials chosen from among a group comprising at least one of the following materials: α-quartz, lithium niobate (LiNbO3), lithium tantalate (LiTaO3), Li2B4O7, AlPO4, GaPO4, langasite (La3Ga5SiO14), ZnO, and epitaxially grown nitrides including Al, Ga or In.

19. A multiple modes sensing system, comprising:

a surface acoustic wave (SAW) sensor comprising a plurality of quartz crystal sensing components for monitoring a chemical species, wherein said plurality of quartz crystal sensing components is disposed within a cavity formed from a plurality of walls of said acoustic wave sensor, wherein each quartz crystal sensing component of said plurality of quartz crystal sensing components is coated with a differing sensing film; and

a plurality of oscillators associated with said plurality of quartz crystal sensing components, wherein each quartz crystal sensing components of said plurality of quartz crystal sensing components is located in a feedback loop with an oscillator of said plurality of oscillators to thereby provide a multiple mode SAW sensor that provides multiple mode frequency outputs thereof, wherein a calculated difference among said multiple mode frequency outputs is utilized to promote an increase in sensing accuracy by eliminating responses due to environmental changes other than said monitored

chemical species.

20. The system of claim 19 wherein said multiple mode SAW sensor comprises a humidity sensor, which provides multiple modes that shake away any water droplets condensing upon said multiple mode SAW sensor, thereby permitting said multiple mode SAW sensor to recover quickly from water saturation; and

wherein said multiple modes SAW sensor produces vibrations which break down bonding connections between analytes and said plurality of quartz crystal sensing components.